

“inflated granular protuberances,” render the transfer of both varieties to *Euastrum* inevitable.

Unless a strict line of separation, dependent on these characters, is maintained between these two very closely allied genera, I need hardly observe that it becomes impossible to assign correct positions to the numerous varieties bordering on *E. elegans* and *E. binale*, on the one hand, and on *Cosmarium quadratum* and *C. Meneghini* on the other.

In side view, each segment presents one central and two terminal granular inflations, united by a constricted neck. The frond is compressed. The ends of the basal lobes are rounded, whilst those of the terminal ones are truncate, angular, or sub-angular,—the granular bodies being confined to the outer third of each lobe.

Var. β . The terminal lobe almost obsolete. Seen in the end view, the two segments appear octagonal, and united by one of their sides.

In this case, also, the fronds have been observed undergoing division. The varieties are therefore mature forms.

Length $\cdot 0018''$; breadth $\cdot 0016''$.

Var. β . Length $\cdot 0010''$; breadth $\cdot 0018''$.

Lower Bengal.

Plate XIV. fig. 12. Front view. Fig. 13. Side view. Fig. 14. Front view of var. β . Fig. 15. Basal view of segment. Fig. 16. Side view.

[To be continued.]

XXXII.—On the Nomenclature of the Foraminifera.

By W. K. PARKER, M. Micr. Soc., and T. R. JONES, F.G.S.

[Continued from p. 183.]

Part IV.—The Species enumerated by Lamarck.

THE Lamarekian species of *Foraminifera*, though treated as microscopic Cephalopods, and represented by very bare engravings, are recognizable, especially by those who have carefully examined the Rhizopodous fauna of the Eocene Tertiary beds of France (particularly the “Calcaire grossier”), whence Lamarck obtained his specimens. As these comprise several important generic and specific types, as well as some peculiar varietal conditions, Lamarck, in naming them, supplied for the *Foraminifera* several generic names (based, however, on ill-defined grounds) which have been adopted by subsequent naturalists, the majority of his binomial appellations being serviceable.

In the 'Système des Animaux sans Vertèbres' (1801), Lamarck enumerated a few forms (some being grouped as Molluscs, others as Corals). All but one of these are well known on account of subsequent notices by himself and others.

In the 'Annales du Muséum' (1804), vol. v. p. 179, p. 237, and p. 349, Lamarck more fully described some *Foraminifera* in his 'Suite des Mémoires sur les Fossiles des Environs de Paris.' Most of these were figured in the Ann. Mus. vol. viii. pl. 62. figs. 7-16, and vol. ix. pl. 17. figs. 1-6. Nearly all these figures were copied in the 'Tableau Encyclopédique et Méthodique' (Part 23, 1816), pl. 465. figs. 2-4, 6-8; pl. 466. figs. 1-8; and pl. 469. figs. 2, 3. In the 'Histoire Naturelle des Animaux sans Vertèbres' (1816-22), vols. ii. & vii., Lamarck again described his species (with one or two exceptions), and added two others, arranging the whole under a new classification, which, however, being (like the previous arrangement) based on the supposed Cephalopodous character of these little shells, is of no account.

In the 'Tableau Encycl. Méth.' (pl. 466-470), others besides those first described by Lamarck are figured; namely, a few from older authors, and several of the forms figured and described by Fichtel and Moll: but as little need be said respecting these besides restoring to them their original trivial names (many of which have been twice altered by Lamarck,—once in the 'Tabl. Encycl. Méth.,' and again in the 'Anim. s. Vert.),' we shall treat of them by themselves, after having noticed in detail the real Lamarckian species.

The figures given by Lamarck in the 'Annales du Muséum,' used also in the 'Tabl. Enc. Méth.,' were again and again copied by others; especially in Parkinson's 'Organic Remains of a Former World' (1811), pl. 11; Crouch's 'Illustrated Introduction to Lamarck's Conchology' (1827), pl. 20 & 22; Brown's 'Conchologist's Text-Book' (1833), pl. 10; and Brown's 'Elements of Fossil Conchology' (1843), pl. 1, 2, & 3.

The following are consecutive lists of the *Foraminifera* described and figured by Lamarck in his several works —

'Système des Animaux sans Vertèbres.' Par J. B. Lamarck.
8vo. Paris, 1801.

Lamarck's Names.

Corrected Names.

- | | |
|---|--------------------------------------|
| 1. p. 101. Nummulites lævigata . . . | Nummulina lævigata, <i>Lam.</i> |
| 2. p. 376. Orbitolites complanata . . | Orbitolites complanata, <i>Lam.</i> |
| 3. p. 376. Siderolites calcitrapoïdes . | Calcarina Spengleri, <i>Gmel.</i> |
| 4. p. 401. Rotalites tuberculosa . . . | Rotalia trochidiformis?, <i>Lam.</i> |
| 5. p. 402. Oveolites Margaritula . . | Ovulites Margaritula, <i>Lam.</i> |

'Annales du Muséum,' vol. v. (1804).

	<i>Lamarck's Names.</i>		<i>Corrected Names.</i>
	Page. No.		
6.	183.	1. Discorbites vesicularis	Rotalia Turbo, <i>d'Orb.</i> , var. vesicularis, <i>Lam.</i>
7.	184.	1. Rotalia trochidiformis	Rotalia Turbo, <i>d'Orb.</i> , var. trochidiformis, <i>Lam.</i>
8.	..	2. — lenticularis	} Rotalia Turbo, <i>d'Orb.</i> , var. lenticulina, <i>Lam.</i>
	185.	— var. β . (sinistrorsa)	
9.	..	3. — depressa	Truncatulina depressa, <i>Lam.</i> [<i>Type</i> , Planorbulina faretta, <i>F. & M.</i>]
10.	..	4. — Discorbula	Rotalia Beccarii, <i>Linn.</i>
11.	187.	1. Lenticulites planulata	Nummulina planulata, <i>Lam.</i> [<i>Lam.</i>
12.	..	2. — variolaria	Nummulina planulata, <i>Lam.</i> , var. variolaria,
13.	188.	3. — rotulata	Cristellaria Calcar, <i>Linn.</i> , var. rotulata, <i>Lam.</i>
	1.	241. 1. Nummulites lævigata	Nummulina lævigata, <i>Lam.</i> [<i>Lam.</i>
14.	..	2. — globularia	Nummulina lævigata, <i>Lam.</i> , var. globularia,
15.	..	3. — scabra	Nummulina lævigata, <i>Lam.</i> , var. scabra, <i>Lam.</i>
16.	242.	4. — complanata	Nummulina complanata, <i>Lam.</i>
17.	243.	1. Lituolites nautiloidea	Lituola nautiloidea, <i>Lam.</i>
18.	..	2. — difformis	Lituola nautiloidea, <i>Lam.</i> , var. difformis, <i>Lam.</i>
19.	245.	1. Spirolinites depressa.	Peneroplis planatus, <i>F. & M.</i> [<i>Lam.</i>
20.	..	2. — cylindræa	Peneroplis planatus, <i>F. & M.</i> , var. cylindræa,
21.	..	— var. β . (recta)	Clavulina Clavulus, <i>Lam.</i> [<i>Type</i> , Valvulina triangularis, <i>d'Orb.</i>]
22.	351.	1. Miliolites ringens	Biloculina ringens, <i>Lam.</i>
23.	..	2. — Cor-anguinum	Triloculina cor-anguinum, <i>Lam.</i>
24.	..	3. — trigonula	Triloculina trigonula, <i>Lam.</i>
25.	352.	4. — planulata	} Spiroloculina planulata, <i>Lam.</i>
		var. β . (turgidula)	
		var. γ . (planissima)	
26.	..	5. — Saxorum	} Quinqueloculina Saxorum, <i>Lam.</i>
27.	353.	6. — opposita	
28.	..	7. — birostris	
29.	354.	1. Renulites opercularia	Vertebralina striata, <i>d'Orb.</i> , var. opercularia, <i>Lam.</i>

'Tableau Encyclopédique et Méthodique des Trois Règnes de la Nature. Vingt-troisième Partie. Mollusques et Polypes divers.' Par M. Lamarck. 4to. Paris, 1816.

	<i>Lamarck's Names.</i>		<i>Corrected Names.</i>
	Plate.	fig.	
39.	465.	2 a, b, c.	Nodosaria Raphanus, <i>Linn.</i>
40.		3 a, b, c.	Vaginulina Legumen, <i>Linn.</i> [<i>Type</i> , Nodosaria Raphanus, <i>Linn.</i>]
41.		4 a, b, c.	Nodosaria Radicula, <i>Linn.</i>
17.		6	Lituola nautiloidea, <i>Lam.</i>
20.		7 a, b, c.	Peneroplis planatus, <i>F. & M.</i> , var. cylindræa, <i>Lam.</i>
29.		8	Vertebralina striata, <i>d'Orb.</i> , var. opercularia, <i>Lam.</i>
18.	466.	1 a, b.	Lituola nautiloidea, <i>Lam.</i> , var. difformis, <i>Lam.</i>
20.		2 a, b.	Peneroplis planatus, <i>F. & M.</i> , var. cylindræa, <i>Lam.</i>
21.		3 a, b.	Clavulina Clavulus, <i>Lam.</i> [<i>Type</i> , Valvulina triangularis, <i>d'Orb.</i>]

Plate.	fig.		
17.	466.	4	Lituola nautiloides Lituola nautiloidea, <i>Lam.</i>
13.		5	Lenticulites rotulata Cristellaria Calcar, <i>Linn.</i> , var. rotulata, <i>Lam.</i>
10.		6 a, b.	Discorbula Ariminensis Rotalia Beccarii, <i>Linn.</i>
6.		7 a, b, c.	Discorbites vesicularis Rotalia Turbo, <i>d'Orb.</i> , var. vesicularis, <i>Lam.</i>
7.		8 a, b.	Rotalites trochidiformis Rotalia Turbo, <i>d'Orb.</i> , var. trochidiformis, <i>Lam.</i>
42.		9 a-d.	Pulvinulus repandus Rotalia repanda, <i>F. & M.</i>
43.		10 a-d.	Pulvinulus asterisans Nonionina asterizans, <i>F. & M.</i>
44.	467.	1 a, b, c.	Cristellaria planata Peneroplis planatus, var. <i>a.</i> , <i>F. & M.</i>
45.		2 a, b, c.	Cristellaria dilatata Peneroplis planatus, var. <i>β.</i> , <i>F. & M.</i>
46.		3 a-d.	Cristellaria Cassis Cristellaria Cassis, var. <i>a.</i> , <i>F. & M.</i>
47.		3 e-g.	Cristellaria producta — Cassis, var. <i>β.</i> , <i>F. & M.</i>
48.		4 a, b.	Cristellaria producta — Cassis, var. <i>γ.</i> , <i>F. & M.</i>
49.		4 c, d.	Cristellaria papilionacea — Cassis, var. <i>δ.</i> , <i>F. & M.</i>
50.		5 a-c.	Cristellaria undata — Cassis, var. <i>ε.</i> , <i>F. & M.</i>
51.		6 a-c.	Cristellaria Galea — Galea, <i>F. & M.</i>
52.		7 a-c.	Cristellaria acutaucularis — acutaucularis, <i>F. & M.</i>
53.	468.	1 a-d.	Orbiculina nummata Orbiculina adunca, var. Orbiculus, <i>F. & M.</i>
54.		2 a, b, c.	Orbiculina adunca Orbiculina adunca, <i>F. & M.</i>
55.		3 a-d.	Orbiculina angulata Orbiculina adunca, var. angulata, <i>F. & M.</i>
56.	469.	1 a-f.	Melonites sphaerica Alveolina Melo, var. <i>α.</i> , <i>F. & M.</i>
57.		1 g, h.	Melonites sphaeroidea Alveolina Melo, var. <i>β.</i> , <i>F. & M.</i>
23.	}	2 a, b, c.	Miliolites Cor-anguinum { Trilocula trigonula, <i>Lam.</i> } Type, Miliola Seminulum, <i>Linn.</i>
24.			
26.			
27.	}	3 a, b, c.	Miliolites Saxorum { Quinqueloculina Saxorum, <i>Lam.</i> }
27.			
58.	470.	1 a, b, c.	Vorticialis strigillata Polystomella crispa, <i>Linn.</i> , var. craticulata, <i>F. & M.</i>
59.		2 a, b, c.	Vorticialis depressa Polystomella crispa, <i>Linn.</i> , var. strigillata, subvar. <i>a.</i> , <i>F. & M.</i>
60.		3 a, b.	Vorticialis marginata Polystomella crispa, <i>Linn.</i> , var. strigillata, subvar. <i>β.</i> , <i>F. & M.</i>
3.		4 a-k.	Siderolites calcitrapoïdes Calcarina Spengleri, <i>Gmel.</i>
61.	471.	1 a, b.	Nummulites lenticularis Nummulina lenticularis, var. <i>a.</i> , <i>F. & M.</i> = ? <i>N. planulata</i> , <i>Lam.</i> , var. ? <i>N. planulata</i> , <i>Lam.</i> , var.
62.		2 a, b.	Nummulites Mammilla Nummulina Mamilla, <i>F. & M.</i> = ? <i>N. planulata</i> , <i>Lam.</i> , var.
5.	479.	7.	Ovulites Margaritula Ovulites Margaritula, <i>Lam.</i>
30.		8.	Ovulites elongata Ovulites Margaritula, var. elongata, <i>Lam.</i>

‘Histoire Naturelle des Animaux sans Vertèbres.’ Par M. le Chevalier de Lamarek. 7 vols. 8vo. Paris, 1815–22.

Vol. ii. 1816. *Lamarck's Names.*

Corrected Names.

Page. No.		
31.	189.	Dactylopora cylindracea
5.	194.	1. Ovulites Margaritula Dactylopora Bambusa, <i>P. & J.</i> , var. cylindracea, <i>Lam.</i> [ceca, <i>Lam.</i>
30.		2. — elongata O. Margaritula, var. elongata, <i>Lam.</i>
32.	196.	1. Orbulites marginalis } Orbitolites complanata, <i>Lam.</i>
2.		2. — complanata }

Page.	No.		
33.	197.	3. <i>Orbulites lenticulata</i> ..	<i>Orbitolina concava</i> , var. <i>lenticulata</i> , <i>Lam.</i>
34.		4. — <i>concava</i>	<i>Orbitolina concava</i> , <i>Lam.</i>
35.		5. — <i>macropora</i>	<i>Orbitolites complanata</i> , var. <i>macropora</i> , <i>Lam.</i>
36.		6. — <i>Pileolus</i>	<i>Orbitolina concava</i> , var. <i>Pileolus</i> , <i>Lam.</i>

'An. s. Vert.' vol. vii. 1822.

Lamarck's Names.

Corrected Names.

Page.	No.		
39.	593.	1. <i>Orthocera Raphanus</i> ..	<i>Nodosaria Raphanus</i> , <i>Linn.</i>
63.	594.	2. — <i>Fascia</i>	<i>Nodosaria Raphanus</i> , var. <i>Fascia</i> , <i>Linn.</i>
64.		3. — <i>Raphanistrum</i> ..	<i>Nodosaria Raphanus</i> , var. <i>Raphanistrum</i> , <i>Linn.</i>
65.		4. — <i>obliqua</i>	<i>Nodosaria Raphanus</i> , var. <i>obliqua</i> , <i>Linn.</i>
37.		5. — <i>acicula</i>	<i>Nodosaria Raphanus</i> , <i>Linn.</i> , var. <i>acicula</i> , <i>Lam.</i>
40.	595.	6. — <i>Legumen</i>	<i>Vaginulina Legumen</i> , <i>Linn.</i> [<i>Type</i> , <i>Nodosaria Raphanus</i> , <i>Linn.</i>]
41.	596.	1. <i>Nodosaria Radicula</i>	<i>Nodosaria Raphanus</i> , var. <i>Radicula</i> , <i>Linn.</i>
38.		2. — <i>dentalina</i>	<i>Nodosaria Raphanus</i> , <i>Linn.</i> , var. <i>dentalina</i> ,
66.		3. — <i>Siphunculus</i>	<i>Serpula</i> . [<i>Lam.</i>]
19.	602.	1. <i>Spirolinites depressa</i> ..	<i>Peneroplis planatus</i> , <i>F. & M.</i> [<i>Lam.</i>]
20.		2. — <i>cylindracea</i>	<i>Peneroplis planatus</i> , <i>F. & M.</i> , var. <i>cylindracea</i> ,
21.		— — var. <i>b.</i>	<i>Clavulina Clavulus</i> , <i>Lam.</i> [<i>Type</i> , <i>Valvulina triangularis</i> , <i>d'Orb.</i>]
17.	604.	1. <i>Lituolites nautiloidea</i> ..	<i>Lituola nautiloidea</i> , <i>Lam.</i>
18.	605.	2. — <i>difformis</i>	<i>Lituola nautiloidea</i> , var. <i>difformis</i> , <i>Lam.</i>
29.	606.	1. <i>Renulites opercularis</i> ..	<i>Vertebralina striata</i> , <i>d'Orb.</i> , var. <i>opercularia</i> , <i>Lam.</i>
44.	607.	1. <i>Cristellaria Squammula</i>	<i>Peneroplis planatus</i> , <i>F. & M.</i>
45.		2. — <i>papillosa</i>	} <i>Cristellaria Cassis</i> , varr. $\alpha, \beta, \gamma, \epsilon$, <i>F. & M.</i> } <i>Type</i> , <i>Cristellaria Calcar</i> , <i>Linn.</i>
46. 47. 48. 50.		3. — <i>lævis</i>	
52.	4. — <i>auricularis</i>	<i>Cristellaria acutaauricularis</i> , <i>F. & M.</i>	
63.		5. — <i>Faba</i>	<i>Polystomella crispa</i> , <i>Linn.</i> , var. <i>Faba</i> , <i>F. & M.</i>
64.		6. — <i>Scapha</i>	<i>Polystomella crispa</i> , <i>Linn.</i> , var. <i>Scapha</i> , <i>F. & M.</i>
65.		7. — <i>Crepidula</i>	<i>Cristellaria Calcar</i> , <i>Linn.</i> , var. <i>Crepidula</i> , <i>F. & M.</i>
66.		8. — <i>Auricula</i>	<i>Rotalia repanda</i> , var. <i>Auricula</i> , <i>F. & M.</i>
67.		9. — <i>tuberosa</i>	<i>Planorbulina fareta</i> , var. <i>tuberosa</i> , <i>F. & M.</i>
53.	609.	1. <i>Orbiculina numismalis</i>	<i>Orbiculina adunca</i> , var. <i>Orbiculus</i> , <i>F. & M.</i>
55.		2. — <i>angulata</i>	<i>Orbiculina adunca</i> , var. <i>angulata</i> , <i>F. & M.</i>
54.		3. — <i>uncinata</i>	<i>Orbiculina adunca</i> , <i>F. & M.</i>
22.	612.	1. <i>Miliolites ringens</i>	<i>Biloculina ringens</i> , <i>Lam.</i>
23.		2. — <i>cor-anguinum</i> ..	<i>Triloculina Cor-anguinum</i> , <i>Lam.</i>
24.		3. — <i>trigonula</i>	<i>Triloculina trigonula</i> , <i>Lam.</i>
25.		4. — <i>planulata</i> and 2 varieties } ..	} <i>Type</i> , <i>Miliola Seminulum</i> , <i>Linn.</i>
56.	615.	1. <i>Melonites sphaerica</i>	<i>Alveolina Melo</i> , var. α , <i>F. & M.</i>
57.		2. — <i>sphaeroidea</i>	<i>Alveolina Melo</i> , var. β , <i>F. & M.</i> [<i>Lam.</i>]
7.	617.	1. <i>Rotalites trochidiformis</i>	<i>Rotalia Turbo</i> , <i>d'Orb.</i> , var. <i>trochidiformis</i> ,
11.	619.	1. <i>Lenticulina planulata</i> ..	<i>Nummulina planulata</i> , <i>Lam.</i>
12.		2. — <i>variolaria</i>	<i>Nummulina planulata</i> , var. <i>Variolaria</i> , <i>Lam.</i>
13.		3. — <i>rotulata</i>	<i>Cristellaria Calcar</i> , <i>Linn.</i> , var. <i>rotulata</i> , <i>Lam.</i>

		Page. No.	
42.	621.	1.	<i>Placentula pulvinata</i> .. <i>Rotalia repanda</i> , <i>F. & M.</i>
43.	2.	—	<i>asterisans</i> <i>Polystomella asterizans</i> , <i>F. & M.</i>
6.	623.	1.	<i>Discorbites vesicularis</i> . <i>Rotalia Turbo</i> , <i>d'Orb.</i> , var. <i>vesicularis</i> , <i>Lam.</i>
3.	624.	1.	<i>Siderolites calcitrapoïdes</i> <i>Calcarina Spengleri</i> , <i>Gmel.</i>
68.	625.	1.	<i>Polystomella crisa</i> <i>Polystomella crisa</i> , <i>Linn.</i>
69.	2.	—	<i>costata</i> <i>Cristellaria Calcar</i> , <i>Linn.</i> , var. <i>costata</i> , <i>F. & M.</i>
70.	3.	—	<i>planulata</i> <i>Polystomella crisa</i> , <i>Linn.</i> , var. <i>macella</i> , <i>F. & M.</i>
71.	4.	—	<i>ambigua</i> <i>Polystomella crisa</i> , <i>Linn.</i> , var. <i>ambigua</i> , <i>F. & M.</i>
58.	626.	1.	<i>Vorticalis craticulata</i> .. <i>Polystomella crisa</i> , <i>Linn.</i> , var. <i>craticulata</i> , <i>F. & M.</i>
59.	2.	—	<i>strigilata</i> <i>Polystomella crisa</i> , <i>Linn.</i> , var. <i>strigilata</i> , subvar. <i>α</i> , <i>F. & M.</i>
60.	3.	—	<i>marginata</i> <i>Polystomella crisa</i> , <i>Linn.</i> , var. <i>strigilata</i> , subvar. <i>β</i> , <i>F. & M.</i>
1.	629.	1.	<i>Nummulites lævigata</i> .. <i>Nummulina lævigata</i> , <i>Lam.</i>
14.	2.	—	<i>globularia</i> <i>Nummulina lævigata</i> , var. <i>globularia</i> , <i>Lam.</i>
15.	3.	—	<i>scabra</i> <i>Nummulina lævigata</i> , var. <i>scabra</i> , <i>Lam.</i>
16.	630.	4.	<i>complanata</i> <i>Nummulina complanata</i> , <i>Lam.</i>

1. *Nummulites lævigata*, Syst. An. s. Vert. p. 101; Ann. Mus. v. p. 241, No. 1; viii. pl. 62. fig. 10; Hist. An. s. Vert. vii. p. 629. No. 1. "Fossil: Villers-Coterets." [Defrance adds Soissons and Grignon: Dict. Sc. Nat. xxv. p. 224.]

This appears to have been the first of the coin-shaped Foraminifers, so common in the fossil state as to attract the notice of peasant and of naturalist at an early period, that was subjected to zoological classification under a binomial appellation. A common form in the Eocene Tertiaries of the west of Europe, of large size, and elegantly lenticular in its shape, this was the most prominent of the French *Nummulites*; and its usual smoothness of surface gave rise to its present trivial name; and its tuberculate variety (*N. scabra*) was subsequently catalogued as a different species. The task of sifting the many names that have been given to the several forms of European *Nummulites* has been carefully accomplished by d'Archiac and Haime in their fine Monograph on the Fossils of the Nummulitic Strata of India (4to, Paris, 1853). In the list of synonyms of *N. lævigata*, which is very long (*op. cit.* p. 103), they have given as the first regular name "*Helicites lenticularis*;" but Burtin terms it only *la grande Hélicite ou Lenticulaire*. Bruguière classified it first under the appellation of *Camerina lævigata* (Encycl. Méth. 1789); this was modified to *Nummulites lævigata* by Lamarck (1801), and to *Nummulina lævigata* by D'Orbigny (1826). MM. d'Archiac and Haime have described and illustrated this species in much detail (*op. cit.* p. 104, pl. 4. f. 1-7). Dr. Carpenter also had previously done much to elucidate its structure. (Quart. Journ. Geol. Soc. vol. vi. p. 21, pl. 3 & 4.)

In the 'Ann. Nat. Hist.' 3rd ser. vol. v. p. 109, &c., we have made some remarks on *Nummulinæ* in general (pointing out

especially the erroneous notions published respecting the hyaline columns, or septal pillars), and on *Nummulina lævigata* in particular. This is the type of d'Archiac and Haime's group "subreticulatæ," which we include in the "reticulate" group. It abounded in the European area of the Nummulitic Sea, but appears to be extinct now.

2. *Orbitolites complanata*. Syst. Anim. s. Vert. p. 376; *Orbulites complanata*, Hist. An. s. Vert. ii. p. 196. We must refer the student to Dr. Carpenter's Monograph (Philos. Trans. 1856, vol. cxlvi. p. 181, &c. pl. 4-9) for the history and detailed description of *Orbitolites*,—the subject being there treated most perfectly. *O. complanata* is common in the warmer seas. Of small size in the Mediterranean, it is larger in the Red Sea, and much larger in the Tropics and South Sea. In the fossil state, it is large in some of the Eocene deposits, and is very common in the Tertiaries of Grignon and Hauteville. It has been found also in the Bracklesham beds (by the Rev. O. Fisher, F.G.S.).

For the synonymy of *O. complanata*, see Dr. Carpenter's memoir above referred to, and especially Morris's 'Catalogue of British Fossils,' 1854, p. 39; also Bronn's 'Lethæa Geognost.' third edit. vol. iii. p. 254.

Lamarck's *Orbitolites concava*, Syst. An. s. Vert. p. 376, is evidently a Lunulite; his *Orbulites concava*, in the Hist. An. s. Vert. ii. p. 197, belongs to the *Orbitolina* of D'Orbigny.

3. *Siderolites calcitrapoïdes*. Syst. Anim. s. Vert. p. 376; Tabl. Enc. Méth. pl. 470. figs. 4 a-k. "Fossil; Chalk, Maestricht: Faujas."

This is the same as the "Nautilus Spengleri" of Gmelin, well figured by Spengler, by Faujas, and by Fichtel and Moll. Lamarck grouped it with the Corals; but D'Orbigny, in his 'Tabl. Ceph.,' judiciously placed it in his genus *Calcarina* (Ann. Sc. Nat. vii. p. 276). *Calcarina Spengleri* is noticed in some detail by us in 'Annals Nat. Hist.' 3 ser. vol. iii. p. 480.

4. *Rotalites tuberculosus*. Syst. Anim. s. Vert. p. 401. "Fossil; Grignon."

This is possibly the *Rotalia* afterwards termed *R. trochidiformis* by Lamarck; but it is very ill-defined here, and the name is not repeated in subsequent notices of the Foraminifers of Grignon by either Lamarck or others.

5. *Oveolites Margaritula*. Syst. Anim. s. Vert. p. 402; *Ovulites Margaritula*, Tabl. Enc. Méth. pl. 479. fig. 7; Hist. Anim. s. Vert. ii. p. 194. "Fossil; Grignon."

This is a common Foraminifer of the "Calcaire grossier." Shaped like an egg, and about the size of a mustard-seed, the *Ovulites Margaritula*, when well-grown, is one of the most elegant of the fossil forms. The large terminal apertures, more-

over, in this oval shell curiously impress upon the mind its resemblance to a "blown" bird's egg. The minutely sculptured surface also of many eggs is imitated in the *Ovulite* by minute superficial depressions, leading to tubular perforations; the shell-wall not being imperforate as in the egg.

Though usually met with as tiny opaque white grains, not unlike seed-pearls, yet occasionally specimens that have escaped molecular change present a clear, smooth, glassy appearance, such as belongs to the hyaline group of Foraminifera.

This is the largest of the monothalamous Foraminifera, its one cell averaging the bulk of the entire polythalamous shell of *Miliola*, *Rotalia*, and many others. The *Orbulina universa*, which is another single-celled form, never has its individuals larger than third-rate specimens of *Ovulites*.

Many small varieties of *O. Margaritula* retain their beautiful ovoid shape; but one of the first steps towards degradation is marked by elongation and occasional constriction, giving to the shell a sausage-like appearance. At another step, we have a long straight tube, open at each end (*O. elongata*, Lamarck); this may be as long as, or longer than, the large oval shells; and it may be clavate at one or both extremities, like a drum-stick or a "life-preserver."

The pores in the shell are comparatively large and sparse; in this it resembles *Globigerina*; whilst in *Orbulina universa* we see, intermixed with these larger pores, a great number of minute tubules. As in large *Globigerina* from deep water, and in some varieties of *Bulimina* known as *Bolivina*, the surface of the shell, in some of the elongate varieties of *O. Margaritula*, has a delicate honeycomb-like sculpturing, a pore or tubule lying in the hollow centre of each polygonal mesh.

This monothalamous species, though in some respects comparable to the distomous varieties of *Lagena* (a form related to *Polymorphina* and *Nodosaria*), yet has evidently its affinities with the Rotalian group through *Globigerina*. The enormously elongated cells are not inimical to this view; for some *Rotalia* occasionally have wildly-growing, attenuated, and prolonged chambers.

The *Ovulites* is of considerable interest in a geological point of view. It appears to have been short-lived as a species. Full-developed in the deposits of Hauteville and Grignon, it breaks in at once in the Eocene period. It lingers as an attenuated form in the Miocene beds of San Domingo.

We may remark that other *Monothalamia*, such as *Lagena* and *Orbulina*, seem to us to be also of comparatively recent origin; the latter comes to us first in the Miocene, and the former in the Upper Chalk of Maestricht (a deposit which con-

tains many Foraminifers that abounded afterwards in the Tertiary seas). Whilst both of these Monothalamas are extremely abundant in the existing seas, in almost every latitude and at every depth, a recent Ovulite has not yet been met with. The very restricted distribution of this species in geological time is remarkable; scarcely another Foraminifer presents us with a similarly brief history,—an undescribed form allied to *Dactylopora* affording almost the only parallel (namely, *Acicularia Pavantina*, d'Arch.).

The cylindrical variety of *O. Margaritula* is roughly figured in the 'Tabl. Encycl. Méth.' pl. 479. fig. 8; and the drumstick variety is better figured by Blainville in the 'Dict. Sc. Nat.' Zooph. pl. 48. fig. 3. The large oval Ovulite also is better figured by Blainville (*loc. cit.* fig. 2) than by Lamarck. Michelin (Icon. Zooph. pl. 46. f. 243) figures a double or twin Ovulite. For references to other figures and notices, see Bronn's 'Leth. Geogn.' 3rd edit. iii. p. 258.

6. "Discorbis" was instituted by Lamarck (Ann. Mus. vol. v. p. 182) as a generic name for a group of Rotalian Foraminifera. As he had only met with it in the fossil state, he used the term "Discorbites" in describing the only fossil form of *Discorbis* that he knew, according to his customary plan of modifying the generic name of fossil forms. *Discorbis* and *Discorbites* are not required as generic terms.

Discorbites vesicularis. Ann. Mus. v. p. 183; viii. pl. 62. f. 7: Tabl. Enc. Méth. pl. 466. f. 7 *a, b, c*: Hist. Anim. s. Vert. vii. p. 623. "Fossil; Grignon." [Defrance, Dict. Sc. Nat. xiii. p. 347, gives us other localities, near Versailles, near Mantes, and near Hauteville: he also adds the description of another species from Piedmont, *D. pedemontanus*, Def., and mentions the occurrence of what he believes to be three recent species of *Discorbis*,—one from New Holland, one from the Red Sea, and one from Cherbourg.]

We have in Lamarck's figures some indifferent sketches of a *Rotalia* (both dextral and sinistral), which seems to us to be one which we most commonly meet with in the Calcaire grossier,—a loose-celled and somewhat outspread variety of the more compact *Rotalia Turbo*, d'Orb. (Ann. Sc. Nat. vii. p. 274. No. 39; Modèles, No. 73), which we select as the typical form from amongst a very large group of varieties. The name *Discorbites vesicularis* is given by Defrance to the specimens figured in the 'Dict. Sc. Nat.' Zool. pl. 14. fig. 2 *a, b, c*, which are admirable drawings of the variety under notice when in a rather flatter and more asterigerine* state than those figured by Lamarck.

* Bearing intercalated imperfect chambers arranged starwise on the umbilical face.

D'Orbigny unnecessarily gives to Defrance's figures the name *R. Gervillii* (Ann. Sc. Nat. vii. p. 274, No. 36; Modèles, No. 72. This model is admirable, like most of the others, for its characterization).

Lamarck is not correct in referring this form to *Planus*, Conch. Min. Notis, pl. 1. f. 1 (which is *R. Beccarii*).

7. *Rotalia*. Ann. Mus. v. p. 183. *Rotalites trochidiformis*. Ann. Mus. v. p. 184, No. 1; viii. pl. 62, f. 8 *a, b*; Tabl. Enc. Méth. pl. 466. f. 8 *a, b*; Hist. An. s. Vert. vii. p. 617. "Fossil; Grignon." [Defrance adds, as localities, Fontenai-Saints-Pères and Hauteville, Dict. Sc. Nat. xlvi. p. 303.]

This is one of the largest *Rotaliæ*, and is the most developed form of the group which is typified by *R. Turbo*, d'Orb. A very much better figure is given in the 'Dict. Sc. Nat.' Zool. pl. 14, f. 3 *a, b, c*. This well-grown shell shows faintly the septal markings on its strong, low, conical spire; on the other or umbilical face, which is flatter, the chambers are covered with granules and separated by deep chinks, margined by larger tubercles, such as fill up and overgrow the umbilicus, sometimes leaving evidence of irregular, astral, intercalated lobes or chambers, sometimes masking the whole of the surface. This is the *R. obscura*, Sowerby (Dixon's Foss. Sussex, p. 162, pl. 9, f. 6), and *R. Neuboldii*, d'Arch. & Haime, Foss. Num. de l'Inde, p. 347, pl. 36. f. 17 *a, b, c*.

We have not yet found this gigantic variety of *R. Turbo* recent, although *R. Turbo* and very large specimens of the variety *vesicularis* are extremely abundant on the coast near Melbourne, Australia.

This extreme form of *R. Turbo* is paralleled in development by a large and strongly tuberculate variety of *R. Beccarii* (var. *Schroeteriana*, nob.); by certain thick and granulate subvarieties of *Planorbulina vulgaris* (var. *larvata*, nob.), in which the original features are masked; and by *Polystomella craticulata*,—the extreme development of *P. crispa* and the giant of the *Poly-stomellæ*.

8. *Rotalites lenticularis* (and a sinistral variety). Ann. Mus. v. p. 184, No. 2. "Fossil; Grignon."

Probably a flattish and rather delicate *R. Turbo*, with slightly developed astral flaps. Such a form we find abundantly, fossil at Grignon, and recent on the Australian shores.

9. *Rotalites depressa*. Ann. Mus. v. p. 185, No. 3. "Fossil; Grignon."

This answers well to some of the large Truncatuline varieties of *Planorbulina farcta*: we find many of these in the Calcaire grossier and other French Tertiaries.

10. *Rotalites Discorbula*. Ann. Mus. v. p. 185, No. 4; viii,

pl. 62. f. 9. *Discorbula Ariminensis*, Tabl. Enc. Méth. pl. 466. f. 6 *a, b*. "Fossil; Grignon."

This is *Rotalia Beccarii*, Linn., of common occurrence.

11. *Lenticulina*. Ann. Mus. v. p. 186. This comprises some small *Nummulinæ* and a *Cristellaria*. Lamarck states that he had recent *Lenticulinæ* from the Sea near Teneriffe, taken at 125 feet depth. DeFrance, however, doubts this, and thinks that the specimens were *Cristellariæ*, and probably fossilized (Dict. Sc. Nat. xxv. p. 452). We have found two "*Lenticuline*" forms very common in the sea-sands (at 50 fathoms) off Orotava, Teneriffe, namely, *Amphistegina vulgaris* and *Cristellaria Calcar*, var. *rotulata*. Lamarck's genus "*Lenticulina*" (like his other genera of "microscopic Cephalopodous shells") evidently rests on very indefinite grounds.

Lenticulites planulata. Ann. Mus. v. p. 187, No. 1; Hist. An. s. Vert. vii. p. 619, No. 1. "Fossil; Senlis, Rétheuil near Villers-Coterets, and Soissons." [DeFrance adds Betz and Gilocourt.]

This was recognized as a *Nummulina* by D'Orbigny (Ann. Sc. Nat. vii. p. 296, No. 4); and it is the type of the "radiate" group of Nummulites. (See Annals Nat. Hist. ser. 3. vol. v. p. 109.) *N. planulata* is fully described and illustrated by d'Archiac and Haime (Foss. Num. de l'Inde, p. 142, pl. 9. f. 5-10), by whom also the localities of its occurrence are carefully enumerated.

12. *Lenticulites variolaria*. Ann. Mus. v. p. 187, No. 2; Hist. An. s. Vert. vii. p. 619, No. 2. "Fossil; Grignon, Betz, and Chaumont." [DeFrance adds Parnes and Aey.]

Sowerby recognized this as a Nummulite (under the term *Nummularia variolaria*, Min. Conch. pl. 538. f. 3). D'Archiac and Haime give the history and description of *Nummulina variolaria*, op. cit. p. 146, pl. 9. f. 13 *a-g*. We agree with Prof. Williamson in regarding *N. variolaria* as a small biconvex variety of *N. planulata* (Williamson, Monogr. p. 39).

13. *Lenticulites rotulata*. Ann. Mus. v. p. 180, No. 3; viii. pl. 62. fig. 11; Tabl. Enc. Méth. pl. 466. fig. 5; Hist. An. s. Vert. vii. p. 620, No. 3. "Fossil; Chalk, Meudon."

D'Orbigny (Mém. Soc. Géol. France, 1840, vol. iv. p. 26) was the first to separate this from the other *Lenticulinæ* or *Lenticulites* (which he arranged in their place as *Nummulinæ*), and to group it in the genus *Cristellaria*, defined by him far more correctly than by Lamarck, who had selected a *mélange* of broadly Nautiloid unrelated forms from Fichtel and Moll's plates, and given them this generic name (Anim. s. Vert. vii. p. 607).

Cristellaria rotulata is a common keelless variety of *C. Calcar*

(see *Annals Nat. Hist.* 2 ser. vol. xix. p. 273), and is exceedingly abundant both in the fossil and the recent state.

14. *Nummulites globularia*. *Ann. Mus.* v. p. 241, No. 2; *Hist. An. s. Vert.* vii. p. 629, No. 2.

“Fossil; Rétheuil.” [Defrance adds Morlaie near Chantilly, and Transylvania, *Dict. Sc. Nat.* xxxv. p. 224.]

Defrance was correct in regarding this as merely a variety of *N. lævigata*; it is the Cherry-stone variety.

15. *Nummulites scabra*. *Ann. Mus.* v. p. 241, No. 3; *Hist. An. s. Vert.* vii. p. 629, No. 3. “Fossil; Soissons.” [Defrance adds Parnes and Saint-Félix.]

This is a nearly constant companion of *Nummulina lævigata*; and as every intermediate stage of granulation (from the mere appearance of hyaline spots on the septa and at the points where the inosculating canals of the alar flaps intersect one another, to upraised semicrystalline granules) is readily found among fifty or more specimens from the Nummulitic sandy beds at Bracklesham, Brussels, and elsewhere, we cannot but regard this as a mere variety of *N. lævigata*. Similar conditions obtain with *Nummulina planulata*, especially among its recent Operculine varieties. Nor are the members of the “sinuate” group without their similarly granulate or scabrous conditions of growth.

N. scabra has the same plan of growth that *N. lævigata* has, and closely follows its type in its variations of external form. This has also been noticed by d’Archiac and Haime, whom we cannot follow in giving a specific standing to *N. scabra*. Their remarks on, and history of this form (*Foss. Num. de l’Inde*, p. 107, pl. 4. figs. 9–12) may, however, be studied with advantage.

16. *Nummulites complanata*. *Ann. Mus.* v. p. 242, No. 4; *Hist. An. s. Vert.* vii. p. 630, No. 4. “Fossil; Soissons?”

The locality given by Lamarck with doubt is incorrect. The Nummulite here referred to is recognized as one belonging to Eastern Europe. The detailed account of this Nummulite and its synonymy given by d’Archiac and Haime (*op. cit.* p. 87, pl. 1. figs. 1–3) should be consulted.

With us, *Nummulina complanata* is the specific centre of a suite of forms (peculiar to the East) having narrow, shallow, sinuate alar lobes, and belonging to d’Archiac and Haime’s group “læves aut sublæves,” but which we term “sinuatae.”

17. *Lituola*. *Ann. Mus.* v. p. 242. *Lituolites nautiloidea*, *Ann. Mus.* v. p. 243, No. 1; viii. pl. 62. fig. 12; *Lituola nautiloides*, *Tabl. Enc. Méth.* pl. 465. fig. 6; *Lituolites nautiloidea*, *Hist. An. s. Vert.* vii. p. 604, No. 1. “Fossil; Chalk, Meudon.”

This is a type of an important group of forms among the

white*, opaque, non-tubuliferous, calcareous-shelled *Rhizopoda*. As in some groups of the hyaline *Foraminifera*, the shell is here principally composed of siliceous sand, the shell-matter being only in sufficient quantity to serve as a cement for the sand-grains.

Lituola, in its simplest form, is a mere string of suboval, successively enlarging chambers, more or less irregular in outline (*Reophax Scorpiurus*, Montfort). A similar, but attached, series of plano-convex chambers (the lower face being often imperfect) has been described as "Œufs de Mollusques" by Cornuel (Mém. Soc. Géol. France, 2 sér. iii. pl. 4. f. 36). These latter often have a more or less coiled set of commencing chambers; and then we have the *Placopsilina Cenomana*, d'Orb. (Reuss, Abhandl. Wien, vii. p. 71, pl. 28. f. 4, 5). These fixed Placopsiline forms are often wild in their growth, spreading and bifurcating with great irregularity and to considerable extent (as much as an inch in length sometimes); simple Nautiloid forms also occur fixed (*Lituola nautiloides*, Schroeter, sp., Ann. Nat. Hist. 3 ser. iii. p. 482). In a free state we find numerous Nautiloid symmetrical *Lituolæ*, of small growth, such as we have already characterized in Ann. Nat. Hist. 2 ser. xix. p. 301, under the name of *Placopsilina Canariensis*, d'Orb. sp., from Norway. A smaller and flatter form is figured by Prof. Williamson (Monogr. p. 34, pl. 3. f. 72, 73) under the name of *Nonionina Jeffreysii*; this is common on the British coasts, and indeed is of wide distribution.

This Nautiloid form of *Lituola* is succeeded by crozier-shaped forms, such as the so-called *Spirolina agglutinans*, d'Orb. For. Foss. Vien. pl. 7. f. 10-12, and the "Spirolinites" so common in the Chalk. Many of the larger of these latter have their chambers subdivided.

The septal opening varies in the different above-mentioned forms, from the simple roundish passage, or Nonionine slit, of the arrested varieties, to the oblong, lobed, jagged, or compound apertures seen in the more typical free shells.

Lituola nautiloidea, Lamarck, is a well-developed crozier-shaped shell: it has its chambers subdivided throughout; and its round or oval, and slightly convex, septal plane is pierced with many passages. It is very common and large in the Chalk.

* In the living state, *Orbitolites*, *Peneroplis*, and *Alveolina* (members of the "opaque" group of *Foraminifera*) have their shell-substance pink or reddish, the milky whiteness of the dead shells being the result of bleaching. This appears also to be the case with regard to *Lituola*; as many recent specimens have a reddish or ferruginous appearance, although their constituent sand-grains are in themselves colourless. Prof. Williamson has noticed a similar condition in other Foraminifers (Monogr. p. 65).

A rectilinear or Nodosaria-like *Lituola*, with an extremely labyrinthic subdivision of its chambers, is common in the Tertiaries of San Domingo, Malaga, and Tuscany (figured by Soldani), and occurs recent in the mud of the Abrolhos Bank, east of Rio Janeiro.

18. *Lituolites difformis*. Ann. Mus. v. p. 243, No. 2; viii. pl. 62. f. 13 *a, b*; Hist. An. s. Vert. vii. p. 605. No. 2; *Lituola difformis*, Tabl. Enc. Méth. pl. 466. f. 1 *a, b*. "Fossil; Chalk, Meudon."

A small irregularly grown *Lituola nautiloidea*.

[To be continued.]

XXXIII.—*On the Marginal Nerves of the Leaves of Mosses.* By GEORGE GULLIVER, F.R.S., Fellow of the Royal College of Surgeons of England, and Honorary Fellow of the Royal College of Surgeons in Ireland.

THE term 'nerve' is here used for the leaf-rib, in the same sense as it has always been employed (though so inconveniently) by botanists, and without the least reference either to the function or to the structure of the very different and more important cords with the same name in the animal kingdom.

While so much attention has been paid to the mid-nerve of moss-leaves, it seems singular that even the existence of the marginal nerves, identical in structure with the mid-nerve, has not been recognized by systematic writers in Britain. At least, I believe there is no notice of the kind in the classical works of Smith and Hooker, nor in the recent 'Bryologia Britannica' of Mr. Wilson; and as in this last excellent book the system of Bruch and Schimper is adopted, I presume the same remark will apply to their celebrated 'Bryologia Europæa,' which I have not yet seen. Moreover, in a cursory reference to M. Schimper's 'Recherches sur les Mousses' (4to, Strasburg, 1850), I could find no such mention of marginal leaf-nerves. Indeed, descriptive bryologists say "nerve excurrent," "nerve vanishing," and so forth, for the mid-nerve, as if there were no other nerve in a moss-leaf, as, no doubt, is most often, but by no means always, the case, independently of the well-known double nerve in certain genera.

This is the more remarkable, as the marginal nerves can be so easily demonstrated by very slight dissection under the microscope, while their course and structure will probably be found to afford good specific characters. Schleiden ('Principles of Scientific Botany,' p. 188, transl. by Dr. Lankester, 8vo. Lond. 1849) has depicted them in *Mnium punctatum*, and justly observes that the leaves of Mosses and their nerves merit a more thorough investigation than they have hitherto received.